

Reg. No.																			
-----------------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code	14082
----------------------------	--------------

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025
 Second Semester
CIVIL ENGINEERING
 (Common to Mechanical Engineering)
20ESCE201 – ENGINEERING MECHANICS
 Regulations - 2020

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

	<i>Marks</i>	<i>K- Level</i>	<i>CO</i>
1. Which of the following is the basic law for mechanics? (a) Newton’s law of viscosity (b) Parallelogram law (c) Newton’s laws of motion (d) Hooke’s law	1	K1	CO1
2. Which of the following is the condition for the three-force theorem in mechanics? (a) The force system should be in equilibrium only (b) The force systems should be non-coplanar (c) The system should be co-planar, parallel (d) The force system should be in equilibrium, co-planar, concurrent, or parallel	1	K1	CO1
3. The couple and the other two force systems in free body diagrams can be easily simplified. (a) Statement is wrong (b) Statement is right if we remove ‘force’ part (c) Statement is right if we remove ‘couple’ part (d) Statement is right	1	K1	CO2
4. What is redundant support? (a) The supports more than necessary to hold the structure (b) The supports consisting of hinge and a roller (c) The supports consisting of hinge only (d) The supports consisting of roller only	1	K1	CO2
5. The phenomena of horizontal pull and push explain what? (a) Theory of friction (b) Theory of relativity (c) Theory of action (d) Theory of forces	1	K1	CO3
6. At what conditions does the Coulomb friction occur between the surfaces in contact of journal bearing? (a) When there is no lubricating fluid (b) When there is no friction fluid (c) When there is no adhesive fluid (d) When there is no cohesive fluid	1	K1	CO3
7. The use of centroid comes in picture as if the non-Uniform loading is of the type of parabola then what will be the best suited answer among the following? (a) The net load will not be formed as all the forces will be cancelled (b) The net force will act the centre of the parabola (c) The net force will act on the base of the loading horizontally (d) The net force will act at the centroid of the parabola	1	K1	CO4
8. Two of the things of the composite materials are to be known so that their mass moment of inertia can be varied. Which of the following is one of them? (a) Weight of the centre of gravity (b) Weight of the body (c) Location of the centroid of gravity (d) Location of the centre of mass	1	K1	CO4

9. When a rigid body is in pure rotation, what is true about all particles in the body? 1 K1 CO5
 (a) They have the same linear velocity (b) They have different angular velocities
 (c) They have the same angular velocity (d) They have the same acceleration
10. D'Alembert's principle converts a dynamic problem into 1 K1 CO6
 (a) A static equilibrium problem (b) A kinematic problem
 (c) A potential energy problem (d) None of these

PART - B (12 × 2 = 24 Marks)

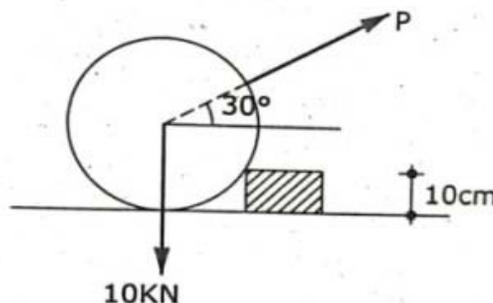
Answer ALL Questions

11. State the triangular law of forces. 2 K1 CO1
12. A force of 500N forms angle 60°, 45° & 120° respectively x, y, z axes. Write the force in vector form. 2 K2 CO1
13. State Varignon's theorem. 2 K1 CO2
14. Write down the conditions of equilibrium of a particle in space. 2 K1 CO2
15. Classify the type of friction. 2 K1 CO3
16. What is co-efficient of Rolling resistance? 2 K1 CO3
17. Define centroid and centre of gravity. 2 K1 CO4
18. Find the polar moment of inertia of a hollow circular section of external diameter 'D' and internal diameter 'd' 2 K2 CO4
19. Define D'Alembert's principle. 2 K1 CO5
20. Compare and contrast the impact and elastic impact. 2 K1 CO5
21. A Car traverses half of a distance with a velocity of 40 Km/h and the remaining half of distance with a velocity of 60km/h. Determine the average velocity. 2 K2 CO4
22. Why is static coefficient of friction μ_s , always greater than kinetic coefficient of friction μ_k . 2 K1 CO4

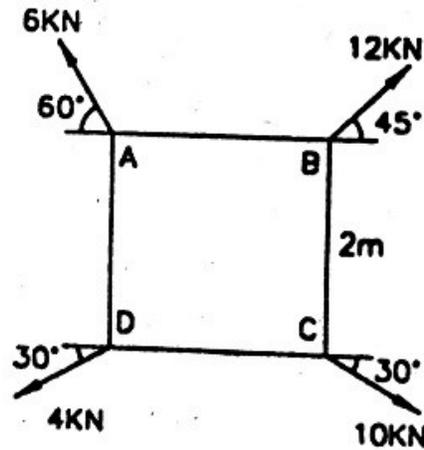
PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23. a) (i) The following forces act a point 6 K3 CO1
 (i) 200 N inclined at 30° towards the North of East.
 (ii) 250 N towards North
 (iii) 300 N towards North West
 (iv) 350 N inclined at 40° towards South of West. Find the resultant of the force system.
- (ii) State and derive the expression for magnitude and direction of the resultant using the Parallelogram law of forces. 5 K3 CO1
- OR**
- b) A cylindrical roller has a weight of 10 kN and it is being pulled by a force which is inclined at 30° with the horizontal as shown in the figure. While moving it comes across an obstacle 10 cm high. Calculate the force required to cross the obstacle, if the diameter of the roller is 1 m. 11 K3 CO1

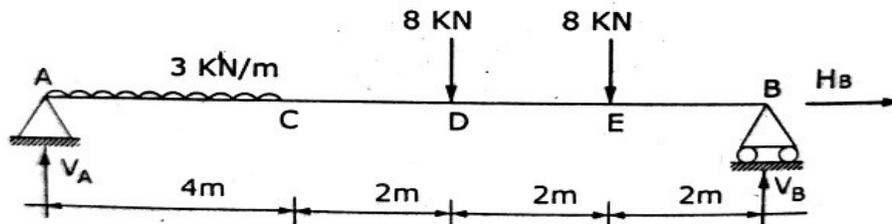


24. a) Four forces of magnitude and direction acting on a square ABCD of side 2 m are shown in the figure. Calculate the resultant in magnitude and direction and also locate its point of application with respect to the sides AB and AD. 11 K3 CO2



OR

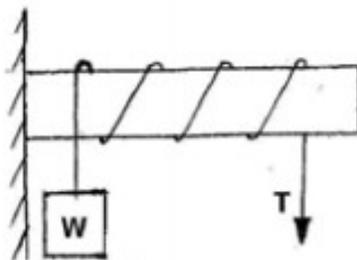
- b) A beam AB of span 10 m span is loaded as shown in the figure. Determine the reactions at A and B. 11 K3 CO2



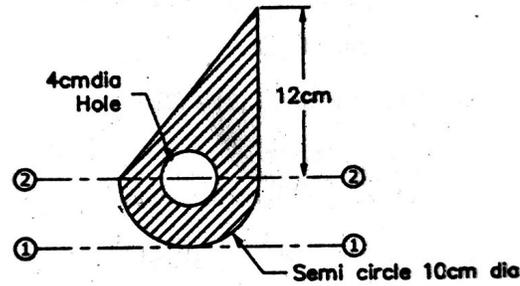
25. a) (i) An effort of 200N is required just to move a certain body up an inclined plane angle 15° , the force is actin parallel to the plane. If the angle of inclination of the plane is made 20° , the effort required being again parallel to the plane, is found to be 230 N. Find the weight of the body and coefficient of friction. 6 K3 CO3
- (ii) Illustrate the force P inclined at an angle of 32° to the inclined plane making an angle of 25 degree with the horizontal plane to slide a block weighing 125 KN (i) up the inclined plane (ii) Down the inclined plane, when $\mu = 0.5$. 5 K3 CO3

OR

- b) A rope is wrapped 3 times around the rod as shown in the fig. Design the force required at the free end of the rope to stop the load $w=20\text{KN}$. Take $\mu=0.3$. 11 K3 CO3

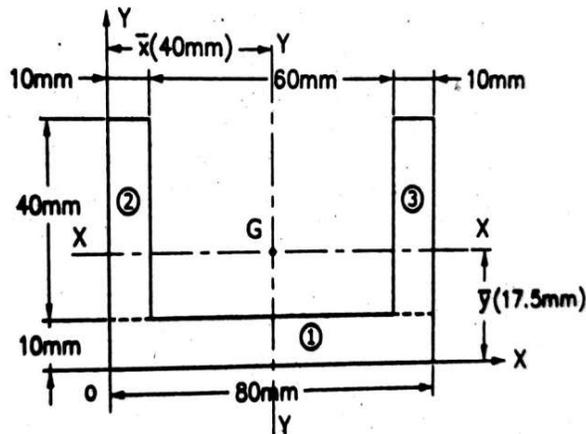


26. a) For the section shown in the figure. Determine the moment of inertia values about the (1) – (1) and (2) – (2) axes. 11 K2 CO4

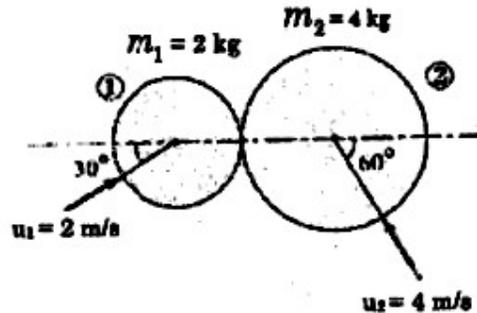


OR

- b) Find the moment of inertia of the section shown below. 11 K2 CO4



27. a) Two smooth spheres 1 and 2 having a mass of 2 kg and 4 kg respectively collide with initial velocities as shown in figure. If the coefficient of restitution for the spheres is $e=0.8$, determine the velocities of each sphere after collision. 11 K2 CO5



OR

- b) A cricket ball hit at a height of 1.5m from the ground by a batsman with a velocity of 20 m/s, at an angle of 30° to the horizontal was caught by field man at a height of 50 cm from the ground. Find out the distance between the two players. 11 K2 CO5

28. a) A cricket ball hit at a height of 1.5m from the ground by a batsman with a velocity of 20 m/s, at an angle of 30° to the horizontal was caught by field man at a height of 50 cm from the ground. Find out the distance between the two players. 11 K3 CO6

OR

- b) A ball of mass 500 grams, moving with a velocity of 1m/s impinges on a ball of mass 1kg, moving with a velocity of 0.75 m/s. at the time of impact, the velocities of the balls are parallel and inclined at 60° to the line joining their centers. Determine the velocities and directions of the balls after impact. Take, $e=0.6$. 11 K3 CO6